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Akimoto et al.

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(54) **LIGHT EMITTING DEVICE AND METHOD FOR MANUFACTURING THE SAME**

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(51) **Int. Cl.**

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H01L 33/60	(2010.01)
H01L 33/48	(2010.01)
H01L 33/62	(2010.01)
H01L 33/50	(2010.01)

(52) **U.S. Cl.**

CPC ***H01L 33/60*** (2013.01); ***H01L 33/005*** (2013.01); ***H01L 33/486*** (2013.01); ***H01L 33/62*** (2013.01); *H01L 33/505* (2013.01); *H01L 2924/0002* (2013.01)

(58) **Field of Classification Search**

CPC H01L 27/156; H01L 33/62
USPC 257/88–99
See application file for complete search history.

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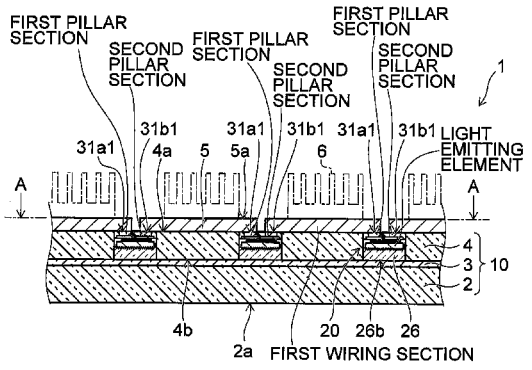
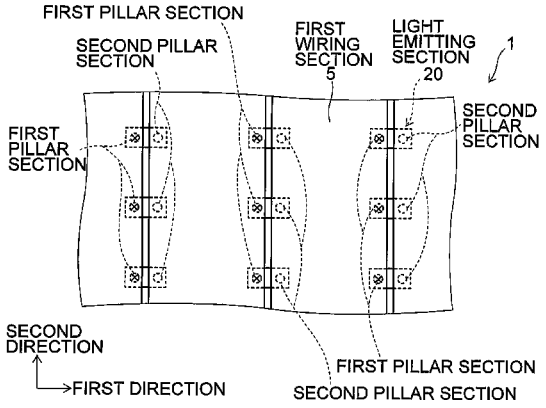
(57) **ABSTRACT**

According to one embodiment, a light emitting device includes a first base section, a light emitting section, and a first wiring section. The light emitting section is embedded on a first surface side of the first base section. The light emitting section includes a light emitting element. The first wiring section is provided on the first surface of the first base section. The first wiring section is connected to the light emitting element.

17 Claims, 10 Drawing Sheets





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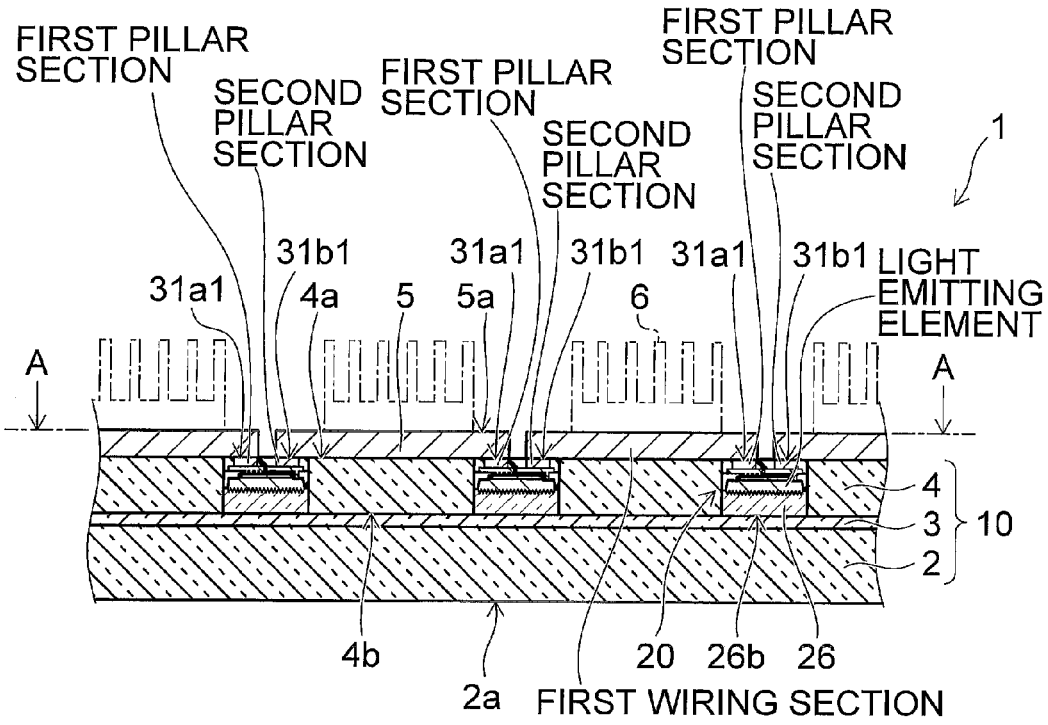
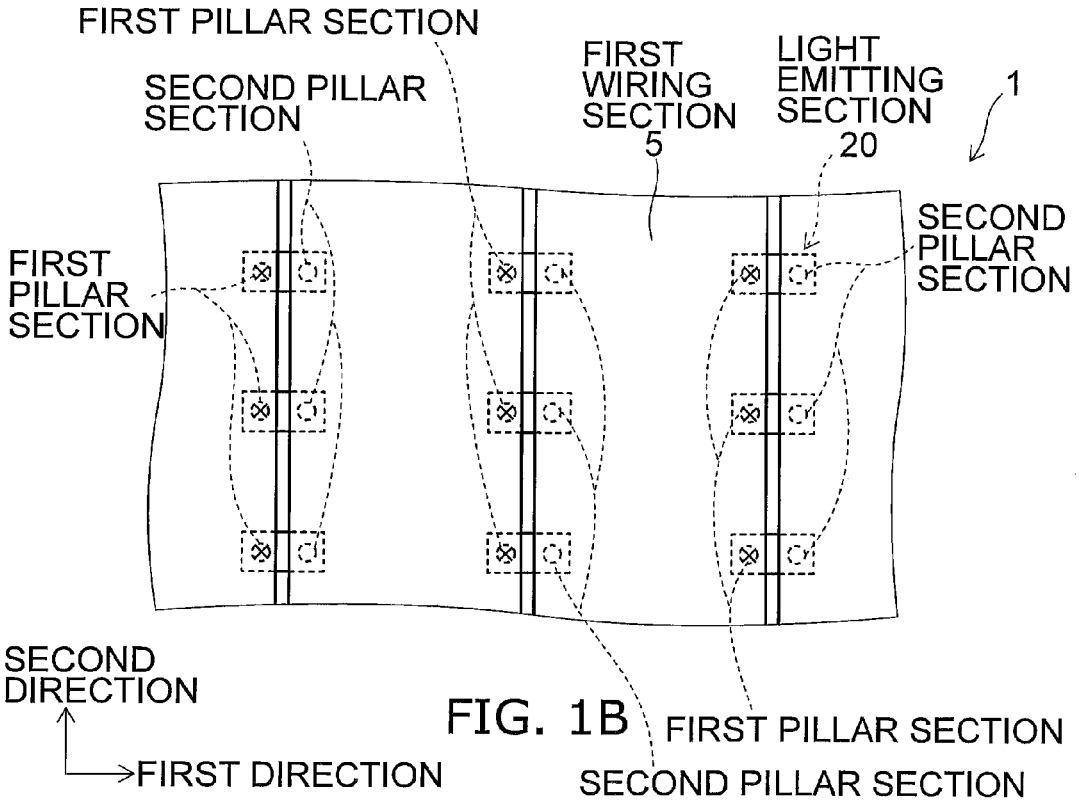

FIRST PILLAR SECTION
SECOND PILLAR SECTION
FIRST PILLAR SECTION
SECOND PILLAR SECTION
FIRST PILLAR SECTION
SECOND PILLAR SECTION
1
31a1
31b1
4a
5
31a1
5a
31b1
6
31a1
31b1
LIGHT EMITTING ELEMENT
A
A
4
3
10
2
4b
2a
20
26b
26
FIRST WIRING SECTION

FIG. 1A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FIRST WIRING SECTION
5
LIGHT EMITTING SECTION
20
1
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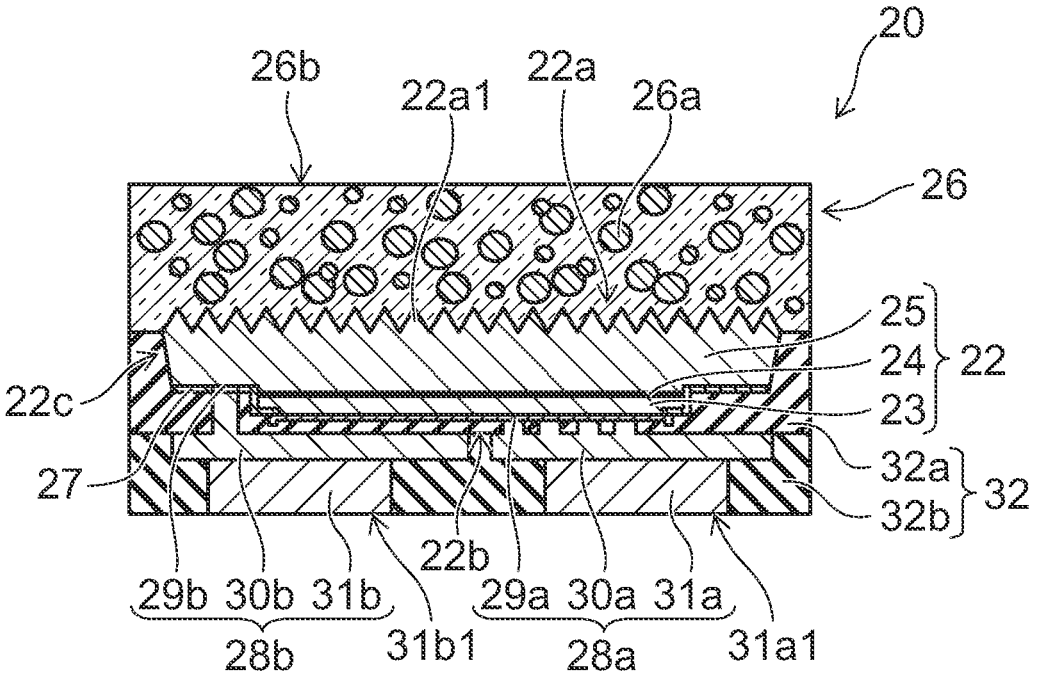
SECOND DIRECTION
FIRST DIRECTION
FIRST PILLAR SECTION
SECOND PILLAR SECTION

FIG. 1B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26b
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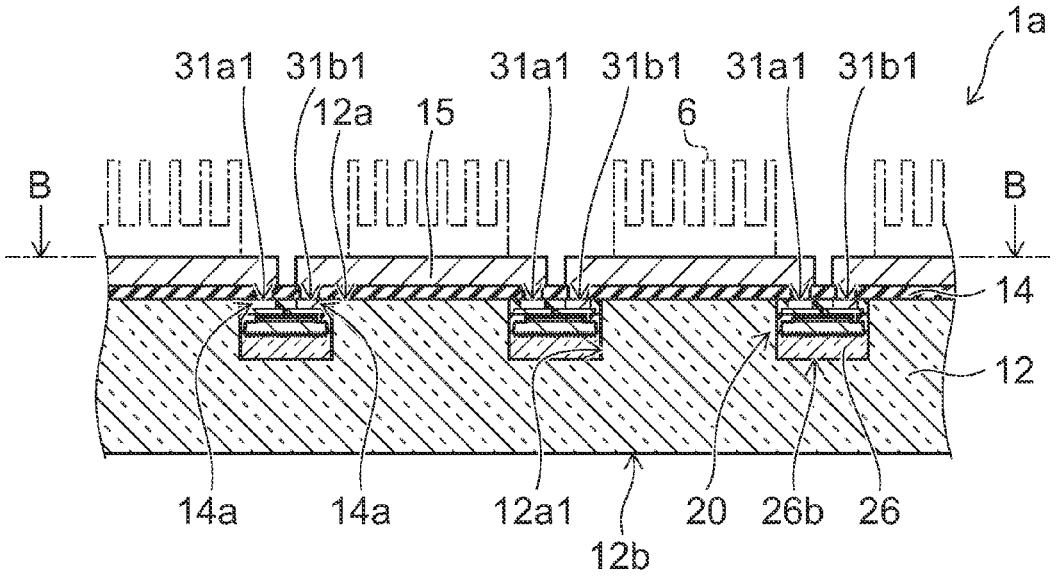
22a
26a
26
25
24
22
22c
23
27
32a
32
32b
22b
29b 30b 31b
29a 30a 31a
28b
31b1
28a
31a1

FIG. 2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31a1
31b1
12a
15
31a1
31b1
6
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31b1
B
B
14
12
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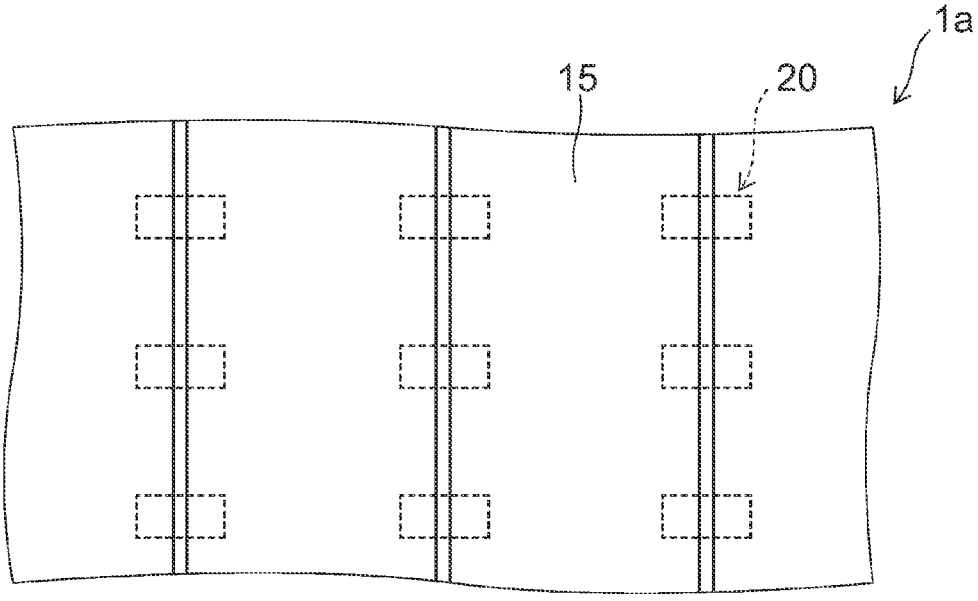
14a
12a1
12b
20
26b
26

FIG. 3A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15
20

FIG. 3B

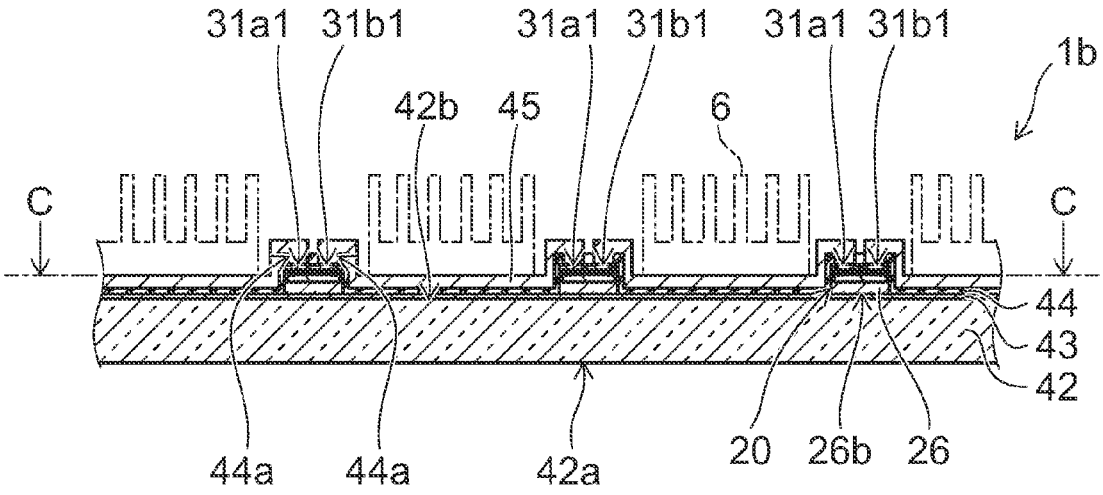
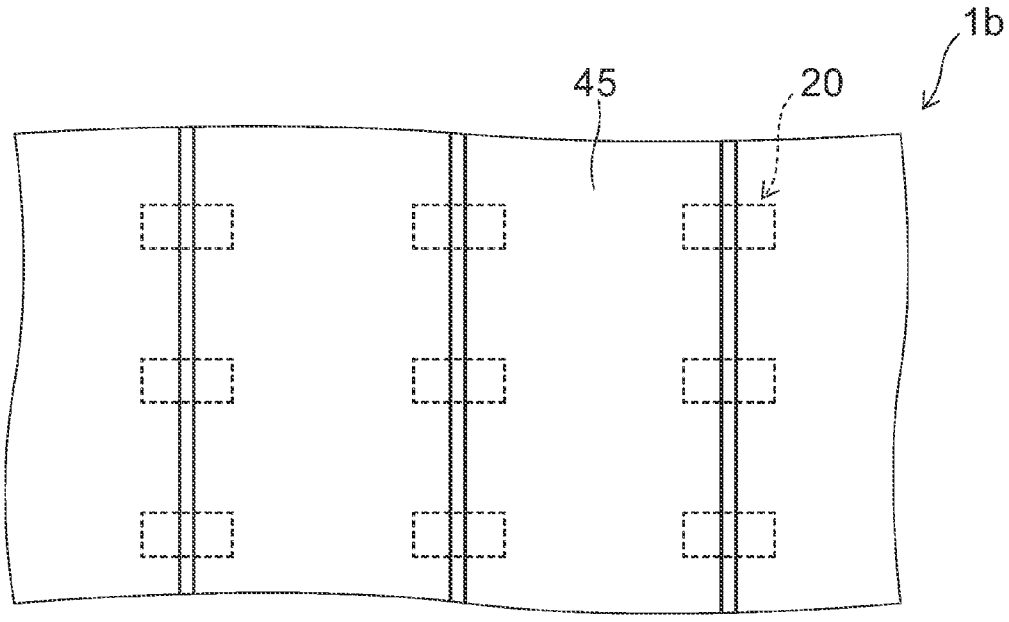

31a1
31b1
31a1
31b1
31a1
31b1
1b
42b
45
6
C
C
44
43
42
44a
44a
42a
20
26b
26

FIG. 4A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20

FIG. 4B

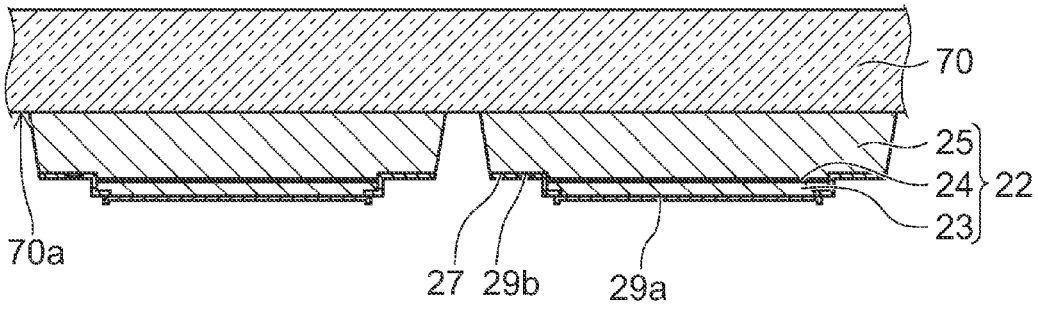


FIG. 5A

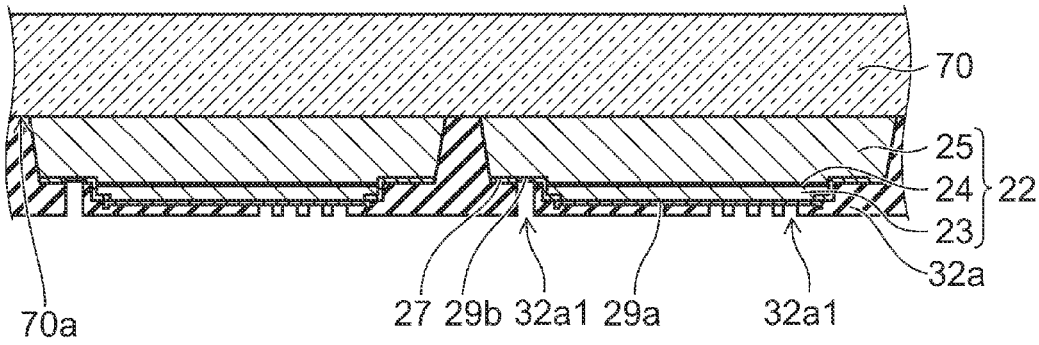


FIG. 5B

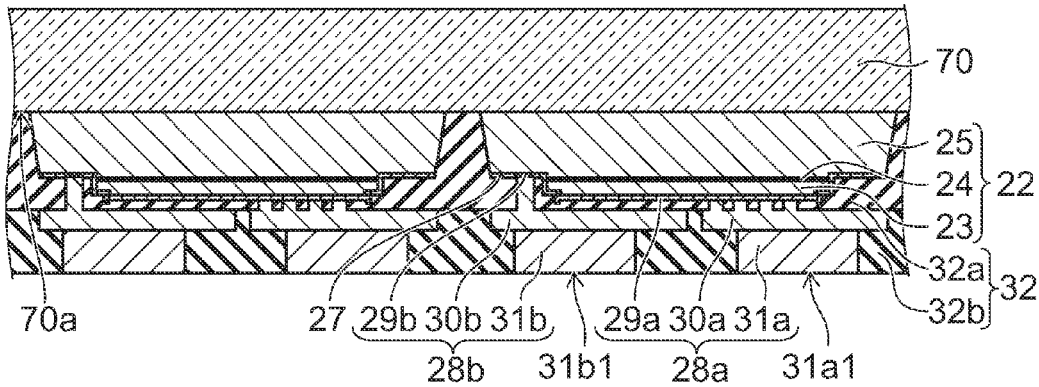
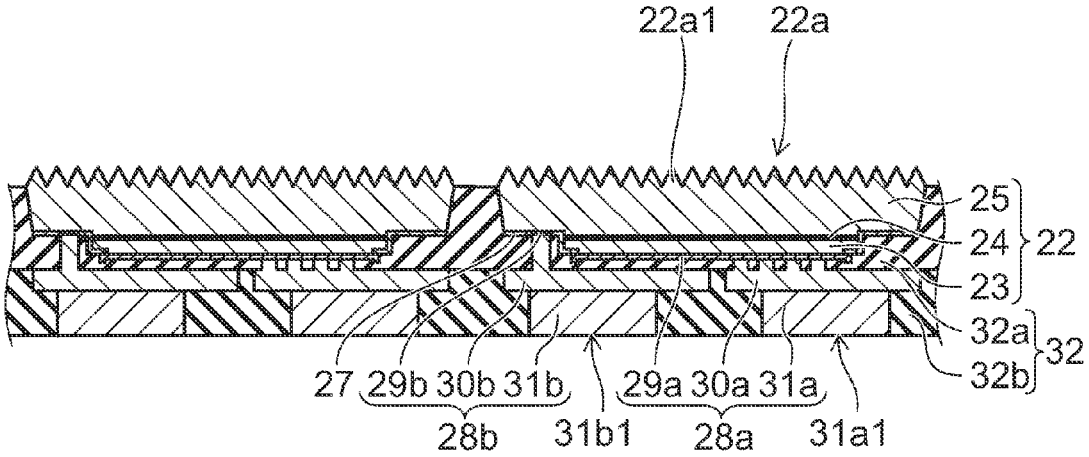


FIG. 5C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22a
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24
22
23
32a
32
32b
27
29b
30b
31b
29a
30a
31a
28b
31b1
28a
31a1

FIG. 6A

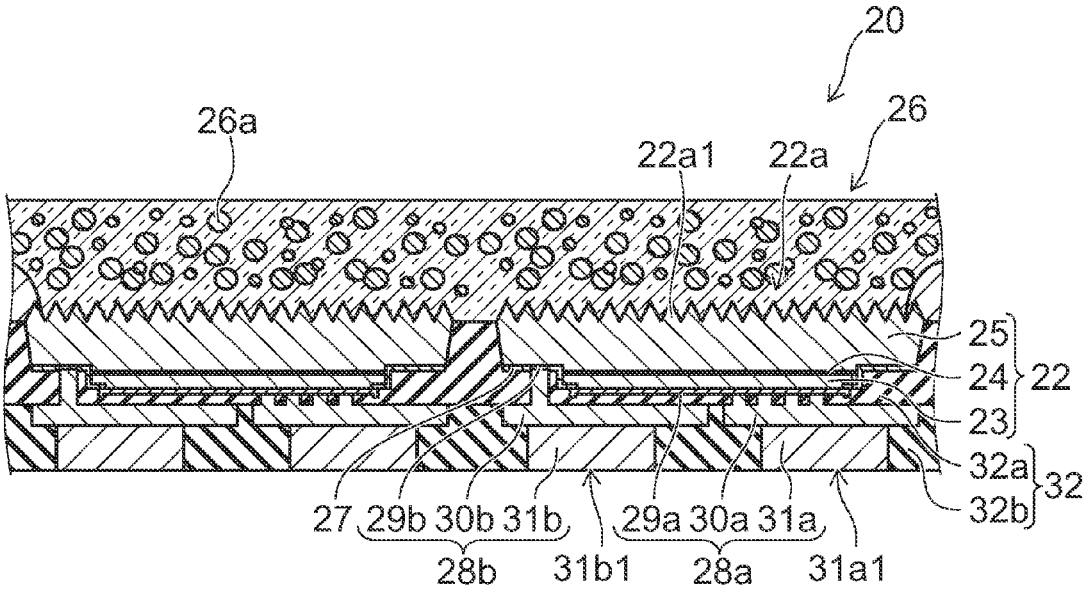

20
26a
26
22a1
22a
25
24
22
23
32a
32
32b
27
29b
30b
31b
29a
30a
31a
28b
31b1
28a
31a1

FIG. 6B

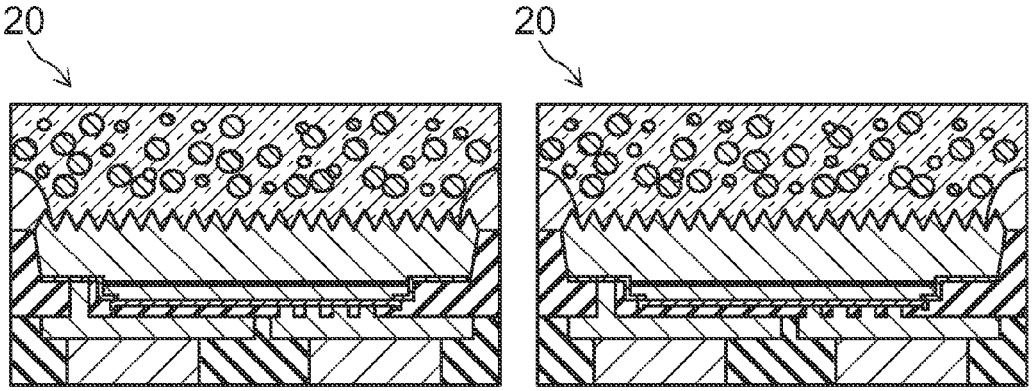


FIG. 7

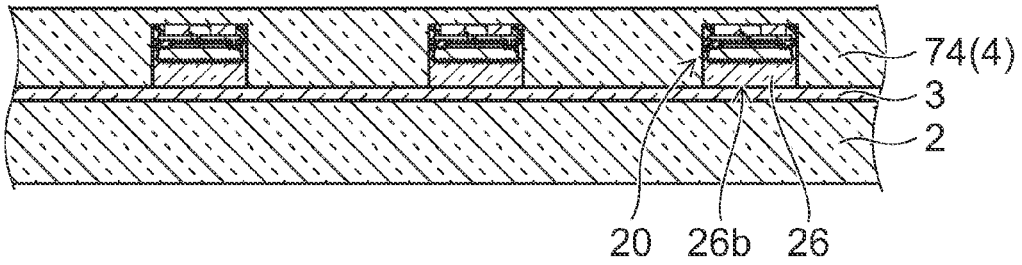


FIG. 8A

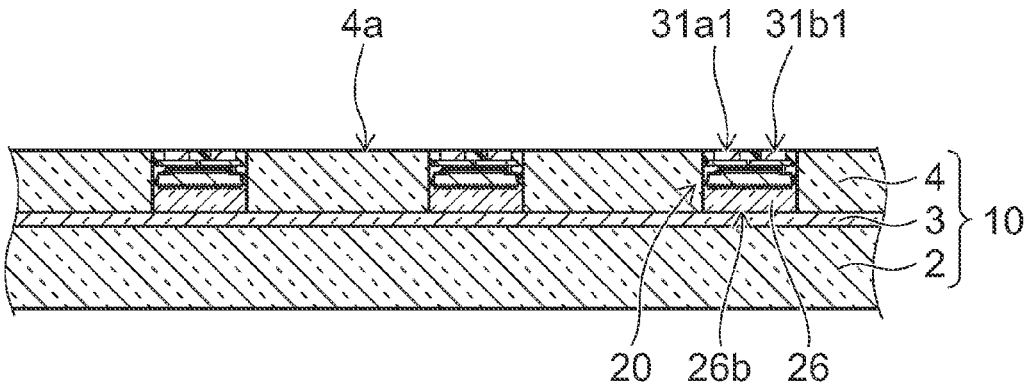


FIG. 8B

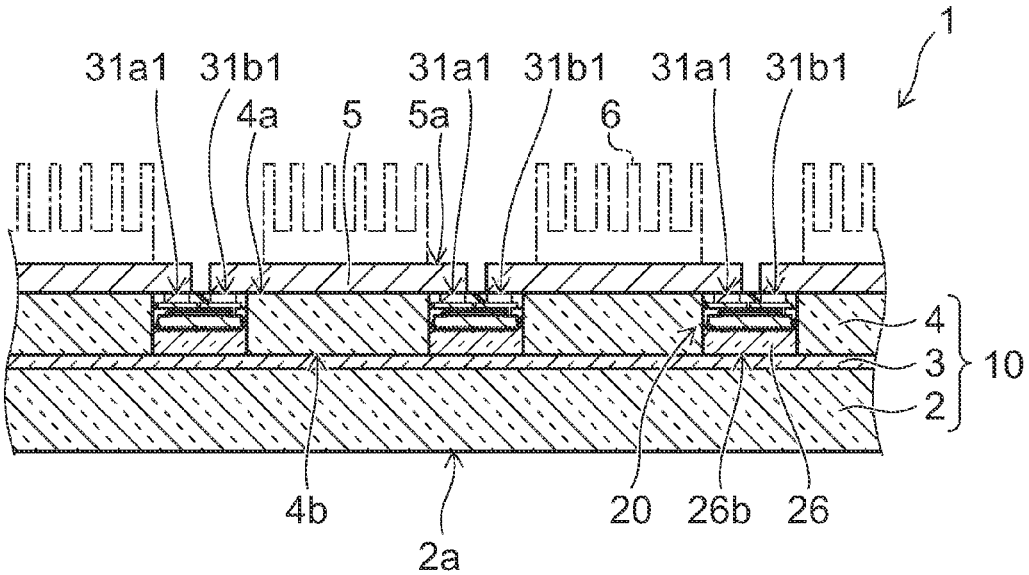


FIG. 8C

FIG. 9A

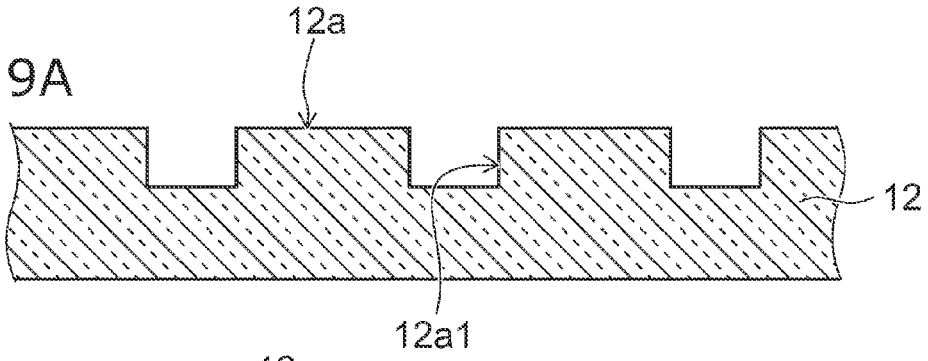


FIG. 9B

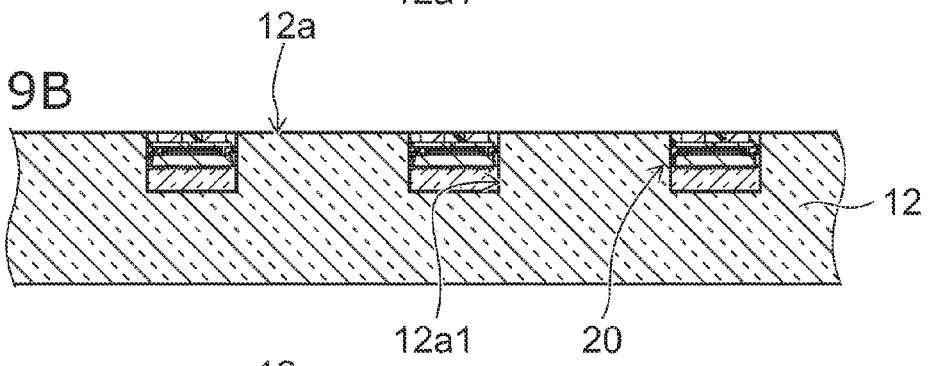


FIG. 9C

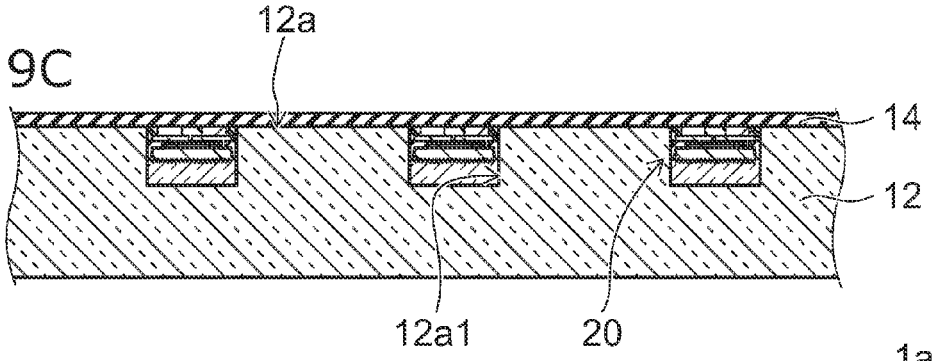
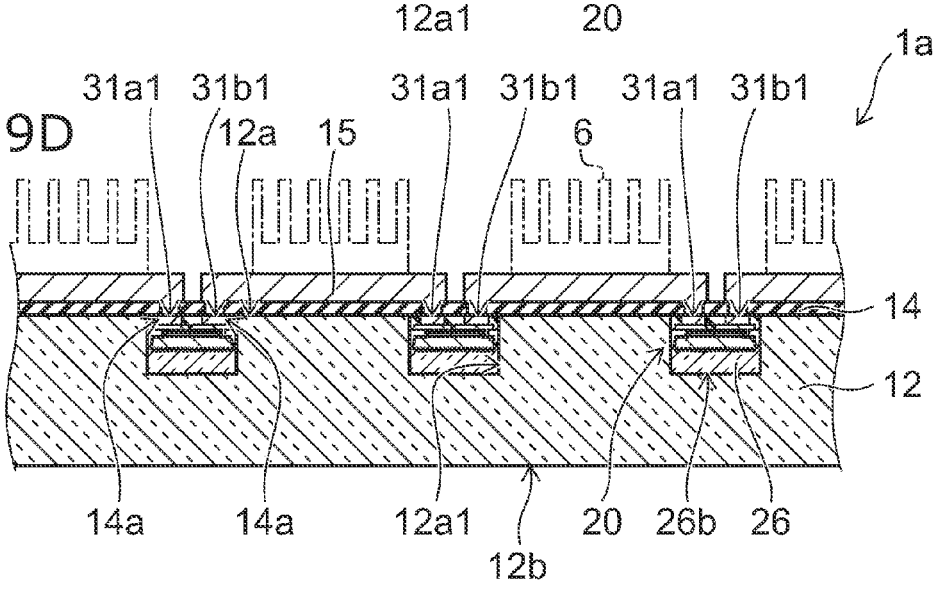
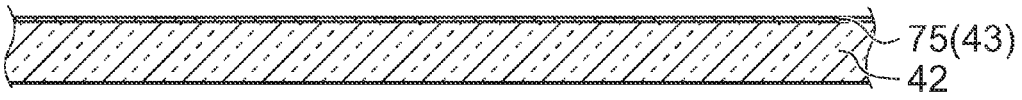


FIG. 9D





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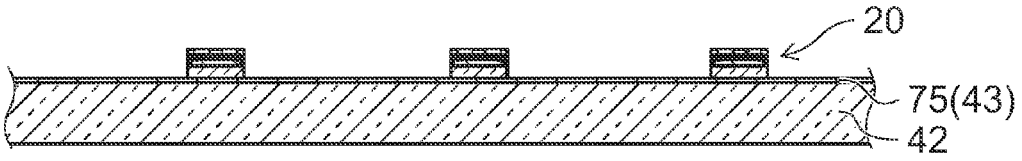

FIG. 10B

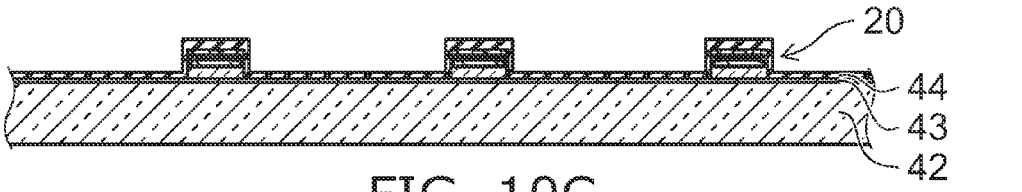

FIG. 10C

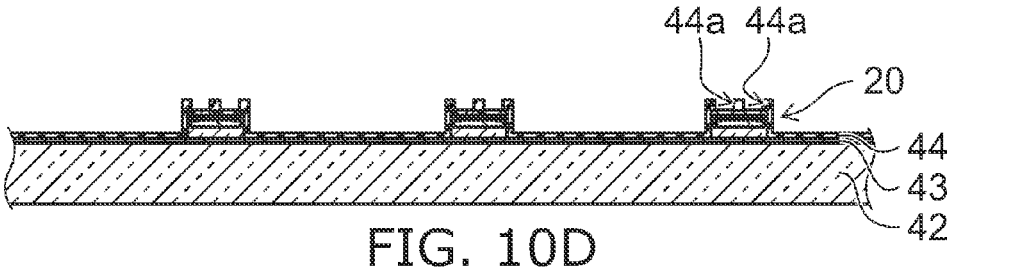

FIG. 10D

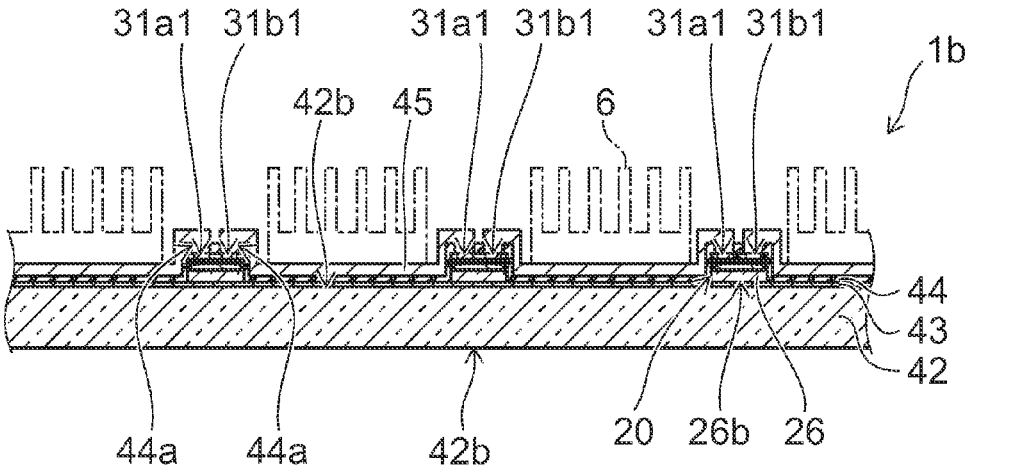

FIG. 10E

LIGHT EMITTING DEVICE AND METHOD FOR MANUFACTURING THE SAME

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is based upon and claims the benefit of priority from Japanese Patent Application No. 2012-062817, filed on Mar. 19, 2012; the entire contents of which are incorporated herein by reference.

FIELD

Embodiments described herein relate generally to a light emitting device and a method for manufacturing the same.

BACKGROUND

For the purpose of downsizing, there is a light emitting device including a chip-like semiconductor light emitting element (hereinafter simply referred to as light emitting element).

Such a light emitting device has been used in various applications such as the light source of an illumination device, the backlight source of an image display device, and the light source of a display device.

Thus, in addition to downsizing, there is demand for the development of a light emitting device capable of improving the volume productivity.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGS. **1**A and **1**B are schematic views illustrating a light emitting device according to a first embodiment;

FIG. **2** is a schematic sectional view illustrating a light emitting section;

FIGS. **3**A and **3**B are schematic views illustrating a light emitting device according to a second embodiment;

FIGS. **4**A and **4**B are schematic views illustrating a light emitting device according to a third embodiment;

FIGS. **5**A to **5**C are schematic process sectional views illustrating the steps from forming a light emitting element **22** to forming a sealing section **32** in the method for manufacturing a light emitting device,

FIGS. **6**A and **6**B are schematic process sectional views illustrating the steps from forming an uneven portion **22***a***1** to forming a translucent section **26** in the method for manufacturing a light emitting device;

FIG. **7** is a schematic process sectional view illustrating the singulation of the light emitting section **20**;

FIGS. **8**A to **8**C are schematic process sectional views illustrating a method for manufacturing the light emitting device **1** illustrated in FIGS. **1**A and **1**B;

FIGS. **9**A to **9**D are schematic process sectional views illustrating a method for manufacturing the light emitting device **1***a* illustrated in FIGS. **3**A and **3**B; and

FIGS. **10**A to **10**E are schematic process sectional views illustrating a method for manufacturing the light emitting device **1***b* illustrated in FIGS. **4**A and **4**B.

DETAILED DESCRIPTION

In general, according to one embodiment, a light emitting device includes a first base section, a light emitting section, and a first wiring section. The light emitting section is embedded on a first surface side of the first base section. The light emitting section includes a light emitting element. The first wiring section is provided on the first surface of the first base section. The first wiring section is connected to the light emitting element.

Embodiments will now be illustrated with reference to the drawings. In the drawings, similar components are labeled with like reference numerals, and the detailed description thereof is omitted appropriately.

[First Embodiment]

FIGS. **1**A and **1**B are schematic views illustrating a light emitting device according to a first embodiment. Here, FIG. **1**A is a schematic sectional view illustrating the light emitting device. FIG. **1**B is an arrow view taken along line A-A in FIG. **1**A.

FIG. **2** is a schematic sectional view illustrating a light emitting section.

As shown in FIGS. **1**A and **1**B, the light emitting device **1** includes a light emitting section **20**, a base section **10** (corresponding to an example of the first base section), and a wiring section **5** (corresponding to an example of the first wiring section).

First, the light emitting section **20** is illustrated.

The light emitting section **20** includes a light emitting element **22**. The light emitting section **20** is embedded on the surface **4***a* (corresponding to an example of the first surface) side of the base section **10** (second base body **4**). The light emitting section **20** is embedded with the light emitting surface **26***b* directed to the opposite side from the surface **4***a* side of the base section **10**. In this case, the surface of the light emitting section **20** on the opposite side from the light emitting surface **26***b* is located on the same plane as the surface **4***a*.

As shown in FIG. **2**, the light emitting section **20** includes a light emitting element **22**, a translucent section **26**, an insulating section **27**, a first electrode section **28***a*, a second electrode section **28***b*, and a sealing section **32**.

The light emitting element **22** can be e.g. a light emitting diode.

In this case, the light emitting element **22** includes e.g. a first semiconductor layer **23**, a light emitting layer **24** provided on the first semiconductor layer **23**, and a second semiconductor layer **25** provided on the light emitting layer **24**.

The first semiconductor layer **23** is a layer formed from e.g. a semiconductor doped into p-type (p-type semiconductor).

The light emitting layer **24** has e.g. a quantum well structure composed of a well layer in which holes and electrons are recombined to generate light, and a barrier layer having a larger band gap than the well layer.

The second semiconductor layer **25** is a layer formed from e.g. a semiconductor doped into n-type (n-type semiconductor).

In the case where the light emitting element **22** is a blue light emitting diode that emits blue light, the semiconductor is e.g. a nitride semiconductor.

In this case, the nitride semiconductor is e.g. GaN (gallium nitride), AlN (aluminum nitride), AlGaN (aluminum gallium nitride), or InGaN (indium gallium nitride).

The light emitting surface **22***a* of the light emitting element **22** is provided with an uneven portion **22***a***1**.

The uneven portion **22***a***1** scatters the light emitted from the light emitting element **22**. This can increase the efficiency of extracting the light generated in the light emitting element **22**.

The translucent section **26** is provided on the surface **22***a* of the light emitting element **22**. The translucent section **26** includes a translucent material and a phosphor **26***a*.

The translucent material is e.g. a translucent resin. The translucent resin is e.g. epoxy resin, silicone resin, methacrylate resin (PMMA), polycarbonate (PC), cyclic polyolefin (COP), alicyclic acrylate (OZ), allyl diglycol carbonate

(ADC), acrylate resin, fluororesin, hybrid resin of silicone resin and epoxy resin, or urethane resin.

The phosphor **26***a* is particulate. The phosphor **26***a* absorbs part of the light emitted from the light emitting element **22** and emits fluorescence having a prescribed wavelength.

For instance, the phosphor **26***a* can absorb part of blue light emitted from the light emitting element **22** and emit yellow fluorescence. In this case, for instance, blue light not absorbed by the phosphor **26***a* and yellow fluorescence emitted from the phosphor **26***a* are emitted from the translucent section **26**.

It is possible to use one kind of phosphor. Alternatively, it is also possible to use a plurality of kinds of phosphor in combination.

For instance, for blue light emitted from the light emitting element **22**, it is possible to use only a phosphor emitting yellow fluorescence. Alternatively, for blue light emitted from the light emitting element **22**, it is also possible to use a phosphor emitting red fluorescence and a phosphor emitting green fluorescence in combination. In this case, blue light, red light, and green light are emitted from the translucent section **26**.

Examples of the material of the phosphor emitting yellow fluorescence can include the following. However, the phosphor emitting yellow fluorescence is not limited thereto, but can be appropriately modified.

$Li(Eu,Sm)W_2O_8$,
$(Y,Gd)_3(Al,Ga)_5O_{12}:Ce^{3+}$,
$Li_2SrSiO_4:Eu^{2+}$,
$(Sr(Ca,Ba))_3SiO_5:Eu^{2+}$,
$SrSi_2ON_{2.7}:Eu^{2+}$

Examples of the material of the phosphor emitting red fluorescence can include the following. However, the phosphor emitting red fluorescence is not limited thereto, but can be appropriately modified.

$La_2O_2S:Eu,Sm$,
$LaSi_3N_5:Eu^{2+}$,
α-sialon:Eu^{2+},
$CaAlSiN_3:Eu^{2+}$,
$(SrCa)AlSiN_3:Eu^{x+}$,
$Sr_x(Si_yAl_3)_z(O_xN):Eu^{x+}$

Examples of the material of the phosphor emitting green fluorescence can include the following. However, the phosphor emitting green fluorescence is not limited thereto, but can be appropriately modified.

$(Ba,Sr,Mg)O.aAl_2O_3:Mn$,
$(BrSr)SiO_4:Eu$,
α-sialon:Yb^{2+},
β-sialon:Eu^{2+},
$(CaSr)Si_2O_4N_7:Eu^{2+}$,
$Sr(SiAl)(ON):Ce$

The kind and combination of the colors of fluorescence emitted by the phosphor are not limited to those illustrated, but can be appropriately modified depending on the purpose and the like of the light emitting device **1**.

The phosphor **26***a* is not necessarily needed, but can be appropriately provided depending on the purpose and the like of the light emitting device **1**. In the case where the phosphor **26***a* is not provided, the light emitted from the light emitting element **22** is emitted via the translucent section **26**.

The insulating section **27** is provided so as to cover the surface **22***b* on the opposite side from the light emitting side of the light emitting element **22**.

The insulating section **27** can be formed from e.g. SiO_2 (silicon oxide).

The first electrode section **28***a* includes e.g. a first seed section **29***a*, a first electrode wiring **30***a*, and a first pillar section **31***a*.

The second electrode section **28***b* includes e.g. a second seed section **29***b*, a second electrode wiring **30***b*, and a second pillar section **31***b*.

An electrode, not shown, provided on the surface of the first semiconductor layer **23** is connected to the first pillar section **31***a* via the first seed section **29***a* and the first electrode wiring **30***a*. An electrode, not shown, provided on the surface of the second semiconductor layer **25** is connected to the second pillar section **31***b* via the second seed section **29***b* and the second electrode wiring **30***b*.

That is, the first electrode section **28***a* is an extraction electrode connected to the electrode, not shown, provided on the first semiconductor layer **23**. The second electrode section **28***b* is an extraction electrode connected to the electrode, not shown, provided on the second semiconductor layer **25**.

The first seed section **29***a*, the first electrode wiring **30***a*, the first pillar section **31***a*, the second seed section **29***b*, the second electrode wiring **30***b*, and the second pillar section **31***b* can be formed from e.g. a metal such as copper, gold, nickel, and silver. In this case, in view of e.g. thermal conductivity, migration resistance, and adhesiveness to the sealing section **32**, these sections are preferably formed from copper.

The sealing section **32** includes a first sealing section **32***a* and a second sealing section **32***b*.

The first sealing section **32***a* is provided so as to cover the surface **22***b* side and the side surface **22***c* side of the light emitting element **22**.

The second sealing section **32***b* is provided so as to cover the first electrode wiring **30***a*, the first pillar section **31***a*, the second electrode wiring **30***b*, and the second pillar section **31***b*.

However, the end surface **31***a***1** of the first pillar section **31***a* and the end surface **31***b***1** of the second pillar section **31***b* are exposed from the second sealing section **32***b*.

The first sealing section **32***a* and the second sealing section **32***b* can be formed from e.g. an organic material or inorganic material having insulating property. In this case, the first sealing section **32***a*, the second sealing section **32***b*, and the insulating section **27** can be integrally formed.

The thickness of the first pillar section **31***a*, the second pillar section **31***b*, and the second sealing section **32***b* can be thickened. Then, even if the thickness of the light emitting element **22** is thin, the decrease of mechanical strength of the light emitting element **22** can be compensated.

Next, returning to FIGS. **1**A and **1**B, the base section **10** and the wiring section **5** are illustrated.

The base section **10** includes a first base body **2**, a bonding section **3** (corresponding to an example of the first bonding section), and a second base body **4**.

The first base body **2** is plate-like and translucent. The surface **2***a* of the first base body **2** can be provided with an uneven portion, not shown, or a diffusing layer (e.g., a layer made of resin containing fine particles), not shown, for diffusing the emitted light.

The first base body **2** can be formed from e.g. a translucent material. The translucent material is e.g. an organic material such as translucent resin, or an inorganic material such as glass. For instance, the translucent resin can be made similar to that illustrated in the translucent section **26**.

The bonding section **3** is provided on the first base body **2**. The bonding section **3** is translucent. The bonding section **3** bonds the first base body **2** to the light emitting section **20** and the second base body **4**. The bonding section **3** is formed by e.g. curing a transparent adhesive.

The refractive index of the first base body **2**, the refractive index of the bonding section **3**, and the refractive index of the translucent section **26** can be made comparable.

If these refractive indices are made comparable, reflection at the interface between the first base body **2** and the bonding section **3** and at the interface between the translucent section **26** and the bonding section **3** can be suppressed. This can increase the light extraction efficiency.

Furthermore, the refractive index of the first base body **2**, the refractive index of the bonding section **3**, the refractive index of the second base body **4**, and the refractive index of the translucent section **26** can be made comparable. This can further increase the light extraction efficiency.

The second base body **4** is provided on the bonding section **3**, and embeds the light emitting section **20**. That is, the light emitting section **20** is embedded inside the second base body **4**. This can suppress tilting of the light emitting section **20** with respect to the surface **2***a* of the first base body **2**.

The end surface **31***a***1** of the first pillar section **31***a* and the end surface **31***b***1** of the second pillar section **31***b* are exposed from the surface **4***a* of the second base body **4**. The light emitting surface **26***b* of the translucent section **26** is exposed from the other surface **4***b* of the second base body **4**. In the case where the second base body **4** is translucent, the light emitting surface **26***b* of the translucent section **26** may not be exposed from the surface **4***b* of the second base body **4**.

The second base body **4** can be translucent. If the second base body **4** is translucent, the light emitted from the side surface side of the light emitting section **20** can be transmitted. This can suppress narrowing of the directivity of the light emitting section **20**. As a result, the uniformity of the intensity of the light emitted from the light emitting device **1** can be improved. Furthermore, in the case where the light emitting device **1** is a surface emitting module used in e.g. an illumination device, the second base body **4** being translucent can suppress illumination unevenness.

The second base body **4** being translucent can be formed from e.g. a translucent material illustrated in the first base body **2**.

Alternatively, the second base body **4** can be made reflective. If the second base body **4** is reflective, the light emitted from the side surface side of the light emitting section **20** can be reflected. This can narrow the directivity of the light emitting section **20**. That is, mixing of light between the adjacent light emitting sections **20** can be suppressed. For instance, in the case where the light emitting device **1** is used in e.g. a device for displaying characters and images, the second base body **4** being reflective can make the display clear.

The second base body **4** being reflective can be formed from e.g. a white resin, a resin added with a reflective material such as metal, or a metal.

Thus, the material of the second base body **4** can be appropriately selected depending on the purpose and the like of the light emitting device **1**. Thus, the directivity of the light emitting section **20** can be changed.

The wiring section **5** is provided on the surface **4***a* of the base section **10**. The wiring section **5** is electrically connected to the end surface **31***a***1** and the end surface **31***b***1**. That is, the wiring section **5** is connected to the light emitting element **22**. The wiring section **5** can be connected to e.g. an external power supply, not shown. The wiring section **5** can be formed from a metal such as copper, aluminum, and silver. The surface **5***a* of the wiring section **5** can be provided with an oxidation resistant film, not shown. The oxidation resistant film, not shown, can be e.g. a nickel/gold stacked film. The wiring section **5** can be provided so that the light emitting sections **20** are series connected. Alternatively, the wiring section **5** can be provided so that the light emitting sections **20** are parallel connected.

In the example illustrated in FIG. **1**B, a plurality of light emitting sections **20** are provided. The wiring section **5** is provided for each region between the light emitting sections **20**. The wiring section **5** is provided so as to cover the region between the light emitting sections **20**. The wiring sections **5** provided between the light emitting sections **20** are provided on the same plane. The wiring sections **5** provided on the same plane facilitate mounting the light emitting device **1** on another apparatus.

The surface **5***a* of the wiring section **5** is exposed. The surface **5***a* of the wiring section **5** being exposed can improve the dissipation performance of heat from the light emitting sections **20**. Furthermore, the wiring section **5** is planar. The wiring section **5** being planar can further improve the dissipation performance of heat from the light emitting sections **20**. Furthermore, this facilitates providing e.g. a heat dissipation fin **6** on the wiring section **5**.

The cross-sectional area of the end surface **31***a***1** and the end surface **31***b***1** is small. Thus, in typical mounting, solder having a small cross-sectional area is interposed between the end surface **31***a***1**, **31***b***1** and the wiring section. This increases heat resistance in this portion.

In contrast, in this embodiment, the end surface **31***a***1** and the end surface **31***b***1** are directly connected to the wiring section **5**. Thus, solder having a small cross-sectional area is not interposed between the end surface **31***a***1**, **31***b***1** and the wiring section **5**. This can suppress the increase of heat resistance.

The first pillar section **31***a*, the second pillar section **31***b*, and the second sealing section **32***b* of the light emitting section **20** can be omitted. In the case where the first pillar section **31***a*, the second pillar section **31***b*, and the second sealing section **32***b* are not provided, the wiring section **5** may be electrically connected to the first electrode wiring **30***a* and the second electrode wiring **30***b*. Omitting the first pillar section **31***a*, the second pillar section **31***b*, and the second sealing section **32***b* can further reduce the heat resistance.

The light emitting device **1** illustrated in FIGS. **1**A and **1**B includes a plurality of light emitting sections **20**. However, the number of light emitting sections **20** may be one. The layout and the like of the light emitting sections **20** are not limited to those illustrated in FIGS. **1**A and **1**B, but can be appropriately modified.

Furthermore, after producing a light emitting device including a plurality of light emitting sections **20**, this can be cut to obtain a light emitting device including a desired number of light emitting sections **20**.

In the light emitting device **1** according to this embodiment, formation of the base section **10**, provision of the light emitting section **20** on the base section **10**, and wiring of the light emitting section **20**, for instance, can be performed in a sequence of process steps. This can improve the volume productivity.

Furthermore, the light emitting section **20** is embedded inside the second base body **4**. This can suppress tilting of the light emitting section **20** with respect to the first base body **2** in the volume production of the light emitting device **1**.

Furthermore, the wiring section **5** having a prescribed configuration is provided. Thus, the heat dissipation performance can also be improved.

[Second Embodiment]

FIGS. **3**A and **3**B are schematic views illustrating a light emitting device according to a second embodiment. Here, FIG. **3**A is a schematic sectional view illustrating the light emitting device. FIG. **3**B is an arrow view taken along line B-B in FIG. **3**A.

As shown in FIGS. **3**A and **3**B, the light emitting device **1***a* includes a light emitting section **20**, a base section **12** (corresponding to an example of the first base section), a reflecting section **14**, and a wiring section **15** (corresponding to an example of the first wiring section).

The base section **12** is plate-like and translucent. The surface **12***b* of the base section **12** can be provided with an uneven portion, not shown, or a diffusing layer (e.g., a layer made of resin containing fine particles), not shown, for diffusing the emitted light.

The end surface **31***a***1** of the first pillar section **31***a* and the end surface **31***b***1** of the second pillar section **31***b* are exposed from the surface **12***a* (corresponding to an example of the first surface) of the base section **12**.

The base section **12** can be formed from e.g. a translucent material. The translucent material is e.g. an organic material such as translucent resin, or an inorganic material such as glass. For instance, the translucent resin can be made similar to that illustrated in the translucent section **26**.

The refractive index of the base section **12** and the refractive index of the translucent section **26** can be made comparable. If these refractive indices are made comparable, reflection at the interface between the base section **12** and the translucent section **26** can be suppressed. This can increase the light extraction efficiency.

In one surface **12***a* of the base section **12**, a recess **12***a***1** is provided. The light emitting section **20** is provided inside the recess **12***a***1**. That is, the light emitting section **20** is embedded inside the base section **12**. This can suppress tilting of the light emitting section **20** with respect to the other surface **12***b* of the base section **12**.

Furthermore, the light emitted from the side surface side of the light emitting section **20** can be transmitted inside the base section **12**. This can suppress narrowing of the directivity of the light emitting section **20**. As a result, the uniformity of the intensity of the light emitted from the light emitting device la can be improved. Furthermore, in the case where the light emitting device la is a surface emitting module used in e.g. an illumination device, illumination unevenness can be suppressed.

The reflecting section **14** is provided between the base section **12** and the wiring section **15**. The reflecting section **14** is provided so as to cover the surface **12***a* of the base section **12**. The reflecting section **14** is reflective. The reflecting section **14** can be formed from e.g. a white resin such as white resist, or titanium oxide (TiO_2). If the reflecting section **14** is patterned so as to avoid short circuit in the light emitting section **20**, the reflecting section **14** can be formed from a metal such as aluminum. The reflecting section **14** is provided with holes **14***a* for exposing the end surface **31***a***1** and the end surface **31***b***1**.

The reflecting section **14** can be a reflecting section for reflecting light of a prescribed wavelength. For instance, the reflecting section **14** can be a reflecting section for reflecting e.g. red or blue light.

The wiring section **15** is provided on the reflecting section **14**. In this case, the wiring section **15** is electrically connected to the end surface **31***a***1** and the end surface **31***b***1** via the holes **14***a*. That is, the wiring section **15** is connected to the light emitting element **22**. The material, configuration and the like of the wiring section **15** can be made similar to the material, configuration and the like of the wiring section **5** described above.

The light emitting device la according to this embodiment can improve the volume productivity like the light emitting device **1** described above.

Furthermore, the light emitting section **20** is embedded inside the base section **12**. This can suppress tilting of the light emitting section **20** with respect to the base section **12** in the volume production of the light emitting device **1***a*.

Furthermore, the wiring section **15** having a prescribed configuration is provided. Thus, the heat dissipation performance can also be improved.

[Third Embodiment]

FIGS. **4**A and **4**B are schematic views illustrating a light emitting device according to a third embodiment. Here, FIG. **4**A is a schematic sectional view illustrating the light emitting device. FIG. **4**B is an arrow view taken along line C-C in FIG. **4**A.

As shown in FIGS. **4**A and **4**B, the light emitting device **1***b* includes a light emitting section **20**, a base section **42** (corresponding to an example of the second base section), a bonding section **43** (corresponding to an example of the second bonding section), a reflecting section **44** (corresponding to an example of the second reflecting section), and a wiring section **45** (corresponding to an example of the second wiring section).

The light emitting section **20** including a light emitting element **22** is provided on the surface **42***b* (corresponding to an example of the second surface) side of the base section **42**.

The base section **42** is plate-like and translucent. The surface **42***a* of the base section **42** can be provided with an uneven portion, not shown, or a diffusing layer (e.g., a layer made of resin containing fine particles), not shown, for diffusing the emitted light.

The base section **42** can be formed from e.g. a translucent material. The translucent material is e.g. an organic material such as translucent resin, or an inorganic material such as glass. For instance, the translucent resin can be made similar to that illustrated in the translucent section **26**.

The bonding section **43** is translucent. The bonding section **43** is provided so as to cover the surface **42***b* of the base section **42**. The light emitting surface **26***b* of the translucent section **26** is bonded to the base section **42** via the bonding section **43**. That is, the light emitting section **20** is bonded to the base section **42** via the bonding section **43**. The bonding section **43** is formed by e.g. curing a transparent adhesive.

The bonding section **43** only needs to be provided at least between the base section **42** and the light emitting section **20**.

The refractive index of the base section **42**, the refractive index of the bonding section **43**, and the refractive index of the translucent section **26** can be made comparable. If these refractive indices are made comparable, reflection at the interface between the base section **42** and the bonding section **43** and at the interface between the translucent section **26** and the bonding section **43** can be suppressed. This can increase the light extraction efficiency.

The reflecting section **44** is provided so as to cover the surface **42***b* side of the base section **42**. The reflecting section **44** is reflective. If the reflecting section **44** is provided, the light emitted from the side surface side of the light emitting section **20** can be reflected. This can narrow the directivity of the light emitting section **20**. That is, mixing of light between the adjacent light emitting sections **20** can be suppressed. For instance, in the case where the light emitting device lb is used in e.g. a device for displaying characters and images, the reflecting section **44** thus provided can make the display clear.

The reflecting section **44** can be formed from e.g. a white resin such as white resist, a resin added with a reflective material such as metal, or a metal. In the case where the wiring section **45** is formed from a highly reflective material (e.g., aluminum), the reflecting section **44** can be omitted.

The reflecting section **44** is provided with holes **44***a* for exposing the end surface **31***a***1** and the end surface **31***b***1**.

The wiring section **45** is provided on the reflecting section **44**. In this case, the wiring section **45** is electrically connected to the end surface **31***a***1** and the end surface **31***b***1** via the holes **44***a*. That is, the wiring section **45** is connected to the light emitting element **22**. The material, configuration and the like of the wiring section **45** can be made similar to the material, configuration and the like of the wiring section **5** described above.

In the example illustrated in FIGS. **4**A and **4**B, a plurality of light emitting sections **20** are provided. The wiring section **45** is planar. The wiring section **45** is provided for each region between the light emitting sections **20** so as to cover the region between the light emitting sections **20**.

The light emitting device **1***b* according to this embodiment can improve the volume productivity like the light emitting device **1** described above.

Furthermore, the wiring section **45** having a prescribed configuration is provided. Thus, the heat dissipation performance can also be improved.

The light emitting section **20** illustrated above corresponds to the case of the light emitting section **20** based on WLP (wafer-level package).

However, the embodiments are not limited to the light emitting section **20** based on WLP. For instance, the embodiments are also applicable to a light emitting section in which the light emitting element **22** is flip-chip connected to a substrate including a wiring layer.

Next, a method for manufacturing a light emitting device is illustrated.

[Fourth Embodiment]

FIGS. **5**A to **5**C are schematic process sectional views illustrating the steps from forming a light emitting element **22** to forming a sealing section **32** in the method for manufacturing a light emitting device.

First, as shown in FIG. **5**A, on the surface **70***a* of a substrate **70** made of e.g. sapphire, a second semiconductor layer **25**, a light emitting layer **24**, and a first semiconductor layer **23** are formed. That is, a light emitting element **22** including a light emitting surface **22***a* is formed. Then, an insulating section **27** is formed on the surface of the second semiconductor layer **25** and the first semiconductor layer **23**. A first seed section **29***a* is formed on the surface of the first semiconductor layer **23**. A second seed section **29***b* is formed on the surface of the second semiconductor layer **25**.

These components can be formed by using known techniques such as film formation, photolithography, and dry etching.

Next, as shown in FIG. **5**B, a first sealing section **32***a* is formed on the entire surface on the surface **70***a* side. An opening **32***a***1** is formed so as to expose part of the first seed section **29***a* and the second seed section **29***b*.

Next, as shown in FIG. **5**C, by using a known film formation technique, a film constituting a first wiring section **30***a*, a second wiring section **30***b*, a first pillar section **31***a*, and a second pillar section **31***b* is formed. By using the photolithography technique and dry etching technique, a first wiring section **30***a*, a second wiring section **30***b*, a first pillar section **31***a*, and a second pillar section **31***b* are successively formed. Then, by using a technique such as spin coating, a film constituting a second sealing section **32***b* is formed on the entire surface on the surface **70***a* side. The film is planarized so as to expose the end surface **31***a***1** of the first pillar section **31***a* and the end surface **31***b***1** of the second pillar section **31***b*. Thus, a second sealing section **32***b* is formed.

Furthermore, by using a technique such as lift-off, the substrate **70** is removed.

FIGS. **6**A and **6**B are schematic process sectional views illustrating the steps from forming an uneven portion **22***a***1** to forming a translucent section **26** in the method for manufacturing a light emitting device.

First, as shown in FIG. **6**A, an uneven portion **22***a***1** is formed on the surface **22***a* of the light emitting element **22**.

In the case where the second semiconductor layer **25** is formed from e.g. GaN, the uneven portion **22***a***1** can be formed by using the we etching technique. For instance, the surface **22***a* can be we etched with an aqueous solution of tetramethylammonium hydroxide ($(CH_3)_4NOH$) (TMH) or an aqueous solution of potassium hydroxide (KOH) to form an uneven portion **22***a***1** based on the crystal structure.

Alternatively, an uneven portion **22***a***1** can be formed on the surface **22***a* by using the photolithography technique and dry etching technique.

Next, as shown in FIG. **6**B, a translucent section **26** is formed so as to cover the entire surface on the surface **22***a* side of the light emitting element **22**.

The translucent section **26** can be formed by using a technique such as vacuum screen printing and molding.

For instance, by using a technique such as vacuum screen printing and molding, a translucent resin including a phosphor **26***a* is applied to the surface **22***a* side of the light emitting element **22**, and cured to form a translucent section **26**.

As described above, a plurality of light emitting sections **20** can be collectively formed.

Next, the light emitting sections **20** are singulated.

FIG. **7** is a schematic process sectional view illustrating the singulation of the light emitting section **20**.

As shown in FIG. **7**, by cutting between the light emitting sections **20**, the light emitting sections **20** are singulated. Examples of the cutting method can include mechanical cutting using e.g. a diamond blade, cutting based on laser irradiation, and cutting with high-pressure water.

As described above, the light emitting section **20** including the light emitting element **22** can be formed.

FIGS. **8**A to **8**C are schematic process sectional views illustrating a method for manufacturing the light emitting device **1** illustrated in FIGS. **1**A and **1**B.

First, as shown in FIG. **8**A, a bonding section **3** is formed on a first base body **2**. A light emitting section **20** is provided on the bonding section **3**. Then, a film **74** constituting a second base body **4** is formed so as to cover the bonding section **3** and the light emitting section **20**.

For instance, by using a technique such as vacuum screen printing and molding, a transparent adhesive is applied onto the first base body **2** and turned into a semi-cured state. Then, a light emitting section **20** is provided on the semi-cured transparent adhesive, which is then cured. In this case, the cured transparent adhesive constitutes a bonding section **3**. The transparent adhesive can be semi-cured and cured by e.g. heat treatment. The light emitting section **20** can be provided by using e.g. the die mounting technique.

The film **74** constituting a second base body **4** can be formed by e.g. applying a prescribed resin using a technique such as curtain coating, and curing the resin. The applied resin can be cured by e.g. heat treatment.

Next, as shown in FIG. **8**B, the surface of the film **74** is planarized to expose the light emitting section **20**. That is, the planarization is performed until the end surface **31***a***1** and the end surface **31***b***1** are exposed. By such planarization, a second base body **4** is formed. The planarization can be performed by e.g. grinding.

As described above, a light emitting section **20** is embedded on the surface **4***a* side of the base section **10**.

Next, as shown in FIG. **8**C, a wiring section **5** connected to the light emitting element **22** is formed on the surface **4***a* of the base section **10**.

Here, the wiring section **5** having the configuration described above is formed.

For instance, a seed metal layer, not shown, having a prescribed shape is formed on the surface **4***a* by a technique such as evaporation. Then, by using the electrolytic plating technique, a wiring section **5** is formed on the seed metal layer. Furthermore, by using the electrolytic plating technique, an oxidation resistant film made of e.g. nickel/gold can also be formed on the surface of the wiring section **5**.

Furthermore, as necessary, a heat dissipation fin **6** and the like are provided on the wiring section **5**.

Thus, a light emitting device including a plurality of light emitting sections **20** can be manufactured. Furthermore, by cutting a light emitting device including a plurality of light emitting sections **20**, a light emitting device including a desired number of light emitting sections **20** can be obtained. Examples of the cutting method can include mechanical cutting using e.g. a diamond blade, cutting based on laser irradiation, and cutting with high-pressure water.

FIGS. **9**A to **9**D are schematic process sectional views illustrating a method for manufacturing the light emitting device **1***a* illustrated in FIGS. **3**A and **3**B. First, as shown in FIG. **9**A, a recess **12***a***1** is formed on the surface **12***a* side of the base section **12**. The recess **12***a***1** can be formed by e.g. a technique such as grinding and we etching.

Next, as shown in FIG. **9**B, a light emitting section **20** is provided inside the recess **12***a***1**. The light emitting section **20** can be provided by using e.g. the die mounting technique. In the singulation illustrated in FIG. **7**, a plurality of light emitting sections **20** may be provided on an expansion sheet. In this case, by stretching the expansion sheet, the spacing between the light emitting sections **20** can be matched with the spacing between the recesses **12***a***1**. If the spacing between the light emitting sections **20** can be matched with the spacing between the recesses **12***a***1**, a plurality of light emitting sections **20** can be provided at once.

Next, as shown in FIG. **9**C, a reflecting section **14** is formed so as to cover the surface **12***a* of the base section **12** and the light emitting section **20**. The reflecting section **14** can be formed by e.g. applying white resist using a technique such as curtain coating, and curing the resist. The white resist can be cured by e.g. ultraviolet irradiation.

Next, as shown in FIG. **9**D, holes **14***a* are formed in the reflecting section **14**. A wiring section **15** is formed on the reflecting section **14**. For instance, in the case where the reflecting section **14** is formed from white resist, holes **14***a* can be formed by using the photolithography technique. The formation of the wiring section **15** can be made similar to the formation of the wiring section **5** described above.

Furthermore, as necessary, a heat dissipation fin **6** and the like are provided on the wiring section **15**.

Thus, a light emitting device including a plurality of light emitting sections **20** can be manufactured. Furthermore, by cutting a light emitting device including a plurality of light emitting sections **20**, a light emitting device including a desired number of light emitting sections **20** can be obtained. Examples of the cutting method can include mechanical cutting using e.g. a diamond blade, cutting based on laser irradiation, and cutting with high-pressure water.

FIGS. **10**A to **10**E are schematic process sectional views illustrating a method for manufacturing the light emitting device **1***b* illustrated in FIGS. **4**A and **4**B.

First, as shown in FIG. **10**A, a film **75** constituting a bonding section **43** is formed on one surface of a base section **42**.

For instance, by using a technique such as vacuum screen printing and molding, a transparent adhesive is applied onto the base section **42** and turned into a semi-cured state. Thus, the film **75** is formed.

Next, as shown in FIG. **10**B, a light emitting section **20** is provided on the film **75**.

For instance, a light emitting section **20** is provided on the semi-cured film **75**, which is then cured. In this case, the cured film **75** constitutes a bonding section **43**. The transparent adhesive can be semi-cured and cured by e.g. heat treatment. The light emitting section **20** can be provided by using e.g. the die mounting technique.

Next, as shown in FIG. **10**C, a reflecting section **44** is formed so as to cover the bonding section **43** and the light emitting section **20**.

For instance, the reflecting section **44** can be formed by e.g. applying white resist using a technique such as curtain coating, and curing the resist. The white resist can be cured by e.g. ultraviolet irradiation.

Next, as shown in FIG. **10**D, holes **44***a* are formed in the reflecting section **44**.

For instance, in the case where the reflecting section **44** is formed from white resist, holes **44***a* can be formed by using the photolithography technique.

Next, as shown in FIG. **10**E, a wiring section **45** is formed on the reflecting section **44**.

The formation of the wiring section **45** can be made similar to the formation of the wiring section **5** described above.

Furthermore, as necessary, a heat dissipation fin **6** and the like are provided on the wiring section **45**.

Thus, a light emitting device including a plurality of light emitting sections **20** can be manufactured. Furthermore, by cutting a light emitting device including a plurality of light emitting sections **20**, a light emitting device including a desired number of light emitting sections **20** can be obtained. Examples of the cutting method can include mechanical cutting using e.g. a diamond blade, cutting based on laser irradiation, and cutting with high-pressure water.

In the manufacturing method according to this embodiment, the end surface **31***a***1** and the end surface **31***b***1** can be directly connected to the wiring section **5**. Thus, solder having a small cross-sectional area is not interposed between the end surface **31***a***1**, **31***b***1** and the wiring section **5**. This can suppress the increase of heat resistance in this portion. Furthermore, there is no need to perform solder reflow. Thus, there are no such problems as tilting of the light emitting section **20** in solder reflow.

Furthermore, the light emission efficiency of the light emitting section **20** thus formed can be increased.

Moreover, the manufacturing method as described above can improve the volume productivity.

Furthermore, a light emitting section **20** as small as the size of the light emitting element **22** can be easily manufactured. Furthermore, there is no need to use mounting members such as a lead frame and ceramic substrate. Thus, wiring, sealing and the like can be performed on the wafer level. Furthermore, inspection can be performed on the wafer level. Thus, the productivity in the manufacturing process can be improved. As a result, cost reduction is facilitated.

The embodiments illustrated above can realize a light emitting device capable of improving the volume productivity and a method for manufacturing the same.

While certain embodiments have been described, these embodiments have been presented by way of example only, and are not intended to limit the scope of the inventions.

Indeed, the novel embodiments described herein may be embodied in a variety of other forms; furthermore, various omissions, substitutions and changes in the form of the embodiments described herein may be made without departing from the spirit of the inventions. The accompanying claims and their equivalents are intended to cover such forms or modifications as would fall within the scope and spirit of the inventions. Moreover, above-mentioned embodiments can be combined mutually and can be carried out.

What is claimed is:

1. A light emitting device comprising:
- a first base section;
- a plurality of light emitting sections embedded on a first surface side of the first base section, the plurality of light emitting sections being provided side by side in a first direction and a second direction perpendicular to the first direction, wherein:
  - each of the light emitting sections includes a light emitting element, a first electrode wiring, a second electrode wiring, a first pillar section, a second pillar section, and a sealing section;
  - the first pillar section is connected to the light emitting element via the first electrode wiring;
  - the second pillar section is connected to the light emitting element via the second electrode wiring;
  - the sealing section is provided so as to cover the first electrode wiring, the first pillar section, the second electrode wiring, and the second pillar section; and
  - an end surface of the first pillar section and an end surface of the second pillar section are exposed from the sealing section; and
- a first wiring section provided on the first surface of the first base section,
- wherein:
- the first wiring section is connected to and covers an entirety of a top planar region between the first pillar section of one of the light emitting sections and the second pillar section of an adjacent one of the light emitting sections in the first direction;
- the first wiring section is connected to and covers an entirety of a top planar region between the first pillar section of one of the light emitting sections and the first pillar section of an adjacent one of the light emitting sections in the second direction;
- the first wiring section is connected to and covers an entirety of a top planar region between the second pillar section of one of the light emitting sections and the second pillar section of an adjacent one of the light emitting sections in the second direction; and
- the first wiring section is planar.

2. The device according to claim **1**, wherein each of the light emitting sections is embedded with a light emitting surface thereof directed to an opposite side from the first surface side.

3. The device according to claim **1**, wherein the first base section includes:
- a first base body;
- a first bonding section provided on the first base body; and
- a second base body provided on the first bonding section and embedding the light emitting sections therein.

4. The device according to claim **3**, wherein the first base body, the first bonding section, and the second base body are translucent.

5. The device according to claim **3**, wherein the second base body is reflective.

6. The device according to claim **3**, wherein the first base body and the first bonding section are translucent.

7. The device according to claim **3**, wherein:
- each of the light emitting sections includes a translucent section provided on a light emitting surface of the light emitting element thereof, and
- a refractive index of the translucent section, a refractive index of the first base body, and a refractive index of the first bonding section are equal.

8. The device according to claim **3**, wherein:
- each of the light emitting sections includes a translucent section provided on a light emitting surface of the light emitting element thereof, and
- a refractive index of the translucent section, a refractive index of the first base body, a refractive index of the first bonding section, and a refractive index of the second base body are equal.

9. The device according to claim **3**, wherein:
- the first base body is translucent and has a plurality of recesses,
- the first bonding section is translucent,
- the second base body is translucent,
- the plurality of light emitting sections are directly embedded into the plurality of recesses, and
- a refractive index of the first base body, a refractive index of the first bonding section, and a refractive index of the second base body are equal.

10. The device according to claim **1**, wherein:
- each of the light emitting sections includes a translucent section provided on a light emitting surface of the light emitting element thereof, and
- a refractive index of the translucent section and a refractive index of the first base section are equal.

11. The device according to claim **1**, further comprising:
- a reflecting section between the first base section and the first wiring section, the reflecting section being reflective.

12. The device according to claim **1**, wherein a plurality of the first wiring sections are provided, the plurality of the first wiring sections being provided on a same plane.

13. The device according to claim **1**, wherein a surface on an opposite side from a light emitting surface of each light emitting section is provided on a same plane as the first surface.

14. The device according to claim **1**, wherein:
- the first base section is translucent, the first base section has a plurality of recesses on the first surface side, and a refractive index of a bottom surface of each of the plurality of recesses and a refractive index of a side surface of each of the plurality of recesses are equal, and
- the plurality of light emitting sections are directly embedded into the plurality of recesses.

15. A light emitting device comprising:
- a first base section;
- a plurality of light emitting sections provided on a first surface side of the first base section, the plurality of light emitting sections being provided side by side in a first direction and a second direction perpendicular to the first direction, wherein:
  - each of the light emitting sections includes a light emitting element, a first electrode wiring, a second electrode wiring, a first pillar section, a second pillar section, and a sealing section;
  - the first pillar section is connected to the light emitting element via the first electrode wiring;
  - the second pillar section is connected to the light emitting element via the second electrode wiring;

the sealing section is provided so as to cover the first electrode wiring, the first pillar section, the second electrode wiring, and the second pillar section; and

an end surface of the first pillar section and an end surface of the second pillar section are exposed from the sealing section;

a first bonding section provided between the first base section and the light emitting sections;

a first reflecting section provided so as to cover the first surface side of the first base section, the first reflecting section being reflective; and

a first wiring section provided on the first reflecting section, wherein:

the first wiring section is connected to and covers an entirety of a top planar region between the first pillar section of one of the light emitting sections and the second pillar section of an adjacent one of the light emitting sections in the first direction;

the first wiring section is connected to and covers an entirety of a to planar region between the first pillar section of one of the light emitting sections and the first pillar section of an adjacent one of the light emitting sections in the second direction;

the first wiring section is connected to and covers an entirety of a to planar region between the second pillar section of one of the light emitting sections and the second pillar section of an adjacent one of the light emitting sections in the second direction; and

the first wiring section is planar.

16. The device according to claim **15**, wherein:

each of the light emitting sections includes a translucent section provided on a light emitting surface of the light emitting element thereof, and

a refractive index of the translucent section, a refractive index of the first base section, and a refractive index of the first bonding section are equal.

17. The device according to claim **15**, wherein:

the first base section is translucent,

the first bonding section is translucent, and

a refractive index of the first base section and a refractive index of the first bonding section are equal.

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